

Waves	Electromagnetic waves
-------	-----------------------

Learning objectives	MUST (6)	Recall common properties of electromagnetic waves, and the regions of the spectrum
	SHOULD (7)	Characterise the different types of EM radiation, and their suitability for different uses
	COULD (8/9)	Explain how different transmission rates through the atmosphere affect applications of EM radiation.

STARTER: What have these items got in common?

William Herschel's thermometer	Left just outside the red light refracted from a prism, showed temperature increase - infrared
Mrs Roentgen's hand	First deliberate subject of an X-ray. (Was she pleased? No.)
A peanut butter candy bar in Percy Spencer's pocket	Percy Spencer was an engineer working on magnetrons. When a bar of candy in his pocket melted near a magnetron that emitted microwaves, Percy investigated. First deliberately cooked item - popcorn.



Who got paid more?

Percy Spencer, for inventing the microwave oven	Got no royalties, but a one-off payment. Of \$2.
Neil Armstrong, for going to the moon	Didn't actually get paid any more on top of his pilot's salary. He was allowed to claim \$8 for each of the three days of the flight, as allowance for being away from his base.

Nobody would insure the Apollo astronauts. What did they do instead?



Waves	Electromagnetic waves
MUST (6)	Recall common properties of EM waves, and the regions of the spectrum

Electromagnetic waves

Regions of spectrum

Common properties

Ways in which they differ

Fill in as much of the tree map as you can.

Extension: add any applications you can think of to the different regions.

Did we think of....? where do they go in the tree map?

Wavelength, frequency, speed, can be refracted, can be diffracted, ionising ability, ability to penetrate matter, transverse/longitudinal, transfer of energy, can be reflected, can be plane polarised

If X-rays and gamma rays can overlap - how do we distinguish between them in this region?

Electromagnetic waves

EM waves are an electric and magnetic field oscillating perpendicular to each other, both perpendicular to the direction of energy transfer

When a charged particle oscillates, an electromagnetic wave is produced.

Additionally, changes in atoms or their nuclei can be associated with emission or absorption of electromagnetic radiation.

Gamma rays: produced when unstable radioactive nuclei release energy

X-rays: produced when charged particles moving at high speed are stopped

Radio waves: can be produced from oscillations in electrical circuits

Speed of electromagnetic waves in a vacuum = 3×10^8 m/s (c) : good approximation for air

$c = f\lambda$

They do, however, refract in different media, leading to varying speeds (think of a prism and the colour separation: glass's refractive index is not a constant, but a function of wavelength)

Waves

Electromagnetic waves

SHOULD (7)

Characterise the different types of EM radiation, and their suitability for different uses

Use the sheets that you have been given; stick in the graph/charts.

Which are highest frequency? Which are the highest energy?

Think of a way in which we use each of them, **and** a reason why this wavelength of EM radiation is suitable for this purpose.



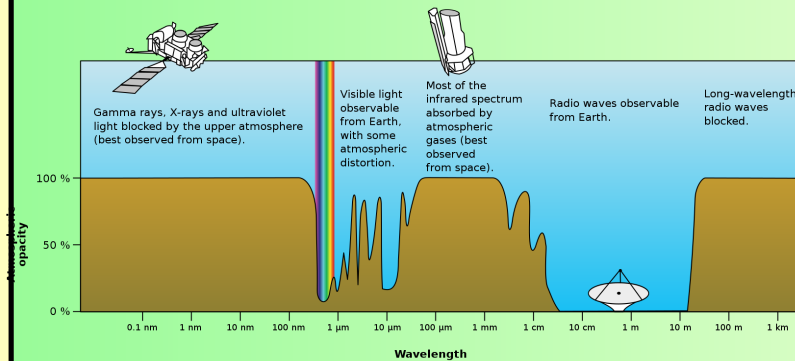
Waves

Electromagnetic radiation

COULD (8/9)

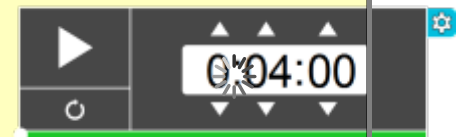
Explain how different transmission rates through the atmosphere affect the applications

Not all wavelengths of EM radiation pass through the atmosphere - the relationship isn't a predictable one (different types of radiation are blocked by different components of the atmosphere).



Carry out the tasks/questions on your worksheet.

Extension: summary questions



Waves	Electromagnetic waves
-------	-----------------------

Learning objectives	MUST (6)	Recall common properties of electromagnetic waves, and the regions of the spectrum
	SHOULD (7)	Characterise the different types of EM radiation, and their suitability for different uses
	COULD (8/9)	Explain how different transmission rates through the atmosphere affect applications of EM radiation.

PLENARY :

Without looking at your notes, can you name.....

5 types of electromagnetic radiation

4 properties in common for all types

3 properties that vary

2 reasons for building telescopes on a mountain

1 type of candy bar that famously melted in a pocket



